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RETINAL HEMORRHAGE AND ITS CONNECTION WITH CEREBRAL, CARDIAC, AND RENAL LESIONS.

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RETINAL hemorrhage, or apoplexy of the retina, is an affection doubly interesting to the ophthalmologist and pathologist, not only intrinsically, but also from its connection with other affections, local as well as general. It is by no means a rare lesion, and offers an interesting field for observation and study, in respect of its causation and pathology.

Its causation is of a twofold nature; that is, the hemorrhage may have an intrinsic and an extrinsic origin. It may arise from disease within the eye, as neuro-retinitis, retinitis, or glaucoma, and is then said to be intrinsic in its origin; or it may originate in cardiac disease, chronic renal disease, or general disease of the vascular walls throughout the body. We occasionally meet with retinal hemorrhage in that obscure class of cases which we group under the head of the hemorrhagic diathesis, where there does not seem to be any particular disease of the vessels, and yet the patients suffer loss of blood from repeated hemorrhages from the mucous membranes and occasionally from the cutaneous surface. A sudden hemorrhage into the retina or vitreous humor, from the rupture of a retinal or choroidal vessel, may arise from some disease of the heart, or from an atheromatous condition of the coats of the vessels, or from chronic disease of the kidneys, and also, though rarely, from suppressed menstruation. When the hemorrhagic diathesis seems to be the predisposing cause, it almost always occurs in young persons, and there are generally multiple extravasations in the retina and vitreous humor. By the aid of the ophthalmoscope we can distinguish three varieties of hemorrhage, and some authorities say four. The first variety consists of small round spots or points, circumscribed or scattered over the whole fundus, though generally in the neighbourhood of a vessel. Secondly, we meet with longitudinal streaks or bands, and these are in the nerve-fibre layer. Thirdly, there occur larger, irregular masses, situated always near the large veins. The

fourth variety is a complete suffusion of the retina, a continuous extravasation of blood. These hemorrhages may be confined entirely to the retina, and this is usually the case; but it is by no means rare to meet with patients who complain of having lost their sight suddenly, and on examining the eye with the ophthalmoscope we get no reflex, and find the whole vitreous humor infiltrated with blood. It does not necessarily follow that this is the worst form of the disease, for the blood is generally absorbed, and some amount of vision at least restored. But in such extensive extravasations the blood generally comes from a ruptured choroidal vessel, showing that the trouble is not confined to the retina, but involves also the vascular tissue of the eye. Where the source of the hemorrhage is a retinal vessel, the extravasation always seems to show a greater tendency to extend outwards to the choroid than inwards towards the vitreous humor.

Apoplexy of the retina, having once occurred, shows a great tendency to recur, and where the recurrences are frequent, they may increase markedly the intraocular tension and give rise to hemorrhagic glaucoma. As an independent lesion, without any accompanying lesion of the tissue of the retina, apoplexy of the retina rarely occurs except in advanced life, most frequently after the fiftieth year, though it may accompany any form of retinitis at any age. Occasionally, though very rarely, it occurs coincidentally with *purpura hemorrhagica*.

M. Ruc, in the "*Union Médicale*" for 1870, cites a case of retinal hemorrhage accompanying an attack of *purpura hemorrhagica* in a labourer, fifty years of age, who was an excessive drinker. Besides numerous spots of *purpura* upon the skin and mucous membrane of the mouth, the man had hematemesis, bloody stools, and numerous large hemorrhages into the retina, with marked disturbance of vision. In the right eye there was a hemorrhage into the macula lutea. Eight days later the spots of extravasation were darker, and in some there appeared small white spots. There was no albuminuria. The autopsy did not show any special changes in the organs, except the hemorrhages, and there was no change in the bloodvessels, as shown by the microscope. Some of the hemorrhages were in the choroid. There were some few fat granules in the tissue of the retina, but none in the walls of the vessels.

When these hemorrhages occur without any inflammatory action in the retina, they must be regarded as a sign of an anomalous state of the circulation, and an unfavourable prognosis is to be given.

Retinal apoplexy is ordinarily accompanied by a slight serous transudation into the tissue of the retina, which gives the latter an cedematous appearance. The prognosis is always more or less unfavourable, not so much on account of possible injury to the vision, as on account of its being a symptom of profound trouble elsewhere.

It often occurs simultaneously with lesion of the heart, and advanced general atheromatous degeneration of the walls of the bloodvessels, which

two morbid conditions are frequently the source of grave cerebral affections. The prognosis becomes still more unfavourable if it is a second or third attack.

When the retina itself is inflamed, then the walls of the vessels are involved. The extravasations in a retinitis are usually slight, but often very numerous. They are generally situated in the inner layers of the retina, but under the pressure of the blood they not unfrequently press into the meshes of its connective tissue framework. In this situation they appear columnar in shape, but near the papilla they are elongated. The frequent occurrence of extravasations in inflammation of the retina finds another cause in the swelling of the optic disk, from the nerve being involved, and the consequent venous congestion. Stellwag tells us that retinal hemorrhages occur not uncommonly in old people, particularly in those having a tendency to capillary hemorrhage of the brain. It is generally conceded that hypertrophy of the left ventricle of the heart increases the tendency to these hemorrhages.

And now, what are the subjective symptoms of a retinal apoplexy? Sometimes, though not very often, the patient may have some premonitory warnings of a faulty circulation, particularly if he is advanced in years. There may be attacks of vertigo and amblyopia, transient in duration, but recurring. But usually the hemorrhage occurs suddenly, and this is one of the most characteristic symptoms. The patient may wake in the morning and find that he is blind in one or both eyes, though usually the disease is confined to one eye, at least in the beginning. It may occur while he is pursuing his ordinary avocations, appearing as a dark red or black spot or ball before the eye, which rapidly extends and obscures the entire field of vision. Of course the impairment of sight produced by the hemorrhage depends on the extent of the effusion and its locality. There may be a single large clot, or a number of small ones. If the clot is a large one, the hyaloid membrane is usually ruptured, and the vitreous humor becomes filled with blood, and this is generally the case when the extravasation comes from a choroidal vessel.

Whether constitutional syphilis exerts any predisposition to retinal hemorrhage is by no means certain. Though inflammation of the retina is a not uncommon symptom in general syphilis, hemorrhages in this form of retinitis are not often seen, and though some authorities assert that syphilitic patients are very predisposed to what is usually called "retinitis apoplectica," their assertions are not sufficiently fortified by actual cases to be of very great value. The form of retinitis observed in constitutional syphilis is not usually of the exudative variety. The retina is swollen and œdematous and soon loses its transparency, but there is rarely anything more than a serous exudation. In a published account of clinical observations made at Wiesbaden for the years 1863 to 1866, Dr. Mandelstamm reports that among nine cases of syphilitic retinitis, there

were four of them accompanied by hemorrhagic extravasations, thus proving the assertion of some observers to be wrong, that apoplexy of the retina never occurs in syphilitic retinitis.

Retinal hemorrhages occur by far more frequently in men than in women, and also much oftener in patients over fifty years of age than under it. In the same report of Dr. Mandelstamm, just quoted, out of 26 cases of retinal apoplexy, 22 occurred in patients from fifty to eighty years of age, and 24 of the 26 cases were in men. Dr. Mandelstamm calls particular attention to the fact that the hemorrhages most frequently occurred in persons between seventy and eighty years of age, and thinks it by no means hypothetical to conclude that they are caused by atheromatous changes in the walls of the bloodvessels. In a report of the same institution at Wiesbaden for the years 1861 and 1862, Dr. Pagenstecher reports 19 cases of retinal apoplexy in two years, and calls attention to the fact that in many of these cases the amount of functional disturbance was comparatively slight, and by no means commensurate with the pathological changes as seen with the ophthalmoscope.

One of the cases was a robust man, thirty-three years of age, who had extensive hemorrhagic extravasations all over the surface of the retina, except at the macula lutea, and yet he read Jaeger No. 4 type, and had a normal field of vision. Five months later the hemorrhages were all absorbed and the patient read Jaeger No. 1 type. In this case there was no organic affection diagnosticated.

The connection of retinal hemorrhage with lesions of the brain, heart, and kidneys is one of very great interest, and at the same time is still somewhat obscure. Perhaps the greatest doubt has been thrown upon the statements of some writers, that the hemorrhages into the retina occurring in elderly people are to be regarded as a premonitory or precursory sign of cerebral apoplexy. Of course, the only way to confirm the statement is to tabulate a sufficient number of cases in which extravasations into the retina have been followed at a varying interval by cerebral hemorrhage. This has not been done, and from the nature of things would be difficult of accomplishment. As a rule, we are unable to keep our patients under observation for any great length of time; yet, with some care I am convinced we might, in time, collect some valuable statistics on this point. I have seen three cases in which retinal apoplexy was followed by cerebral apoplexy, and I have now under observation a fourth case, which I expect will follow the same course. The history of these cases will be given subsequently in detail. Dr. Allbutt, in his valuable work on the ophthalmoscope, says that in cases of large cerebral hemorrhage, where there has been retinal disease and chronic disease of the kidneys, there were usually seen small hemorrhagic extravasations about the optic disks, but considers that these may occur in patients without the danger of an attack of cerebral hemorrhage, and even when the patients do not complain of their vision.

Hemorrhage into the retina has been recorded in a number of cases of encephalic apoplexy, but Dr. Allbutt is not disposed to think that any pressure upon the recurrent vessels could cause a rupture of the retinal vessels unless they were diseased. But we know as an established fact that in all cases of cerebral apoplexy occurring in old people, there is always atheromatous degeneration of the walls of the vessels generally throughout the body, and of course the retinal vessels do not escape.

Dr. Berthold, in the *Klinische Monatsblätter für Augenheilkunde* for April, 1870, relates a case of a woman, between thirty-five and forty years of age, who came to him with the complaint of sudden loss of vision in the right eye, and on examination with the ophthalmoscope he found a hemorrhage into the macula lutea. As he was on the point of dropping in some atropia to dilate the pupil, so that he might examine the whole fundus more carefully, she suddenly complained of feeling unwell, fell back, and died in three-quarters of an hour with all the signs of cerebral apoplexy. Unfortunately there was no autopsy. Dr. Heymann, in the year 1864, in the same journal, relates a case of retinal apoplexy occurring two months after the vision commenced to fail; the hemorrhages were situated near the optic disk, were from the veins, and rapidly increased in size and number. One month after their first appearance came the first attack of unconsciousness and paralysis. Before this the eye had given signs of neuritis and progressive atrophy of the optic nerve fibres. The hemorrhages occurred in both eyes to about the same extent.

There were probably in this last case cerebral lesions at the base of the brain near the left ventricle. The first ophthalmoscopic sign visible was the engorgement of the retinal veins, due to some hindrance to the flow of venous blood. Subsequently the pressure became greater, as was proved by a double sign, narrowing of the arterial calibre and rupture of the veins. Then came the sclerosis of the connective tissue of the nerve and retina, and finally the signs of apoplexy.

Dr. Reynolds considers that clots in the retina are to be regarded as warning symptoms of a cerebral lesion, and after the age of forty, they point at least frequently to the danger of the patient dying of cerebral hemorrhage. Dr. Tanner also considers them as warnings of cerebral lesions, classing them with the sudden transient attacks of blindness and diplopia which are met with. Dr. Hammond says, in speaking of cerebral hemorrhage, that defects of sight may occur, usually characterized by the presence of dark spots in the axis of vision. These are due to minute extravasations of blood into the retina, and are always of most serious importance. He says he has known retinal hemorrhages to precede by more than a year the occurrence of a more severe lesion.

Dr. Colsmann, of Barmen, has reported a number of cases of retinal hemorrhage in the *Berliner Klinische Wochenschrift* for February, 1870, some of which were followed by cerebral apoplexy. He draws particular attention to the fact that the retina is peculiarly liable to disturbances in its circulation, owing to its anatomical connections and anastomoses with

the vessels of the cranial cavity and jugular veins. This may either result in anæmia from hindrance to the arterial current, or in congestive hyperæmia due to pressure on the venous circulation from some cause within or without the cranium. Instances of the latter condition are by no means rare, such as swelling of the tissue of the optic nerve and retina from the pressure caused by tumours within the cranium or orbit, giving us the "*stauungs-papille*" of Von Graefe, in which hemorrhagic extravasations into the retina are very common. Dr. Colzman considers that in a general fatty or atheromatous degeneration of the vessels, retinal hemorrhages are to be regarded as preceding or accompanying cerebral apoplexy. In those cases where there is no perceptible disease of the arteries, he thinks that an increased blood pressure in the cranial veins from whatever cause, is readily propagated to the retinal veins owing to the rich anastomosis of the ophthalmic vein with the cavernous sinus. We no doubt sometimes meet with cases in which there is apparently no cause for the retinal hemorrhages, and these are just the ones which require most minute and careful scrutiny. A rigid examination will usually establish some etiological connection between the state of the retina and some other organ or tissue in the body.

One of Dr. Colzman's cases was a very corpulent woman, without any organic lesion, who had suffered from repeated attacks of retinal apoplexy. His ninth reported case was one of repeated hemorrhages into the retina in a woman, sixty-two years of age. There were a number of small, bandlike hemorrhages all over the retina of both eyes, some recent, others which had undergone retrogressive metamorphosis. There was no other disease of the eyes, nor of any organ in the body which might cause these extravasations. The sight improved somewhat as the hemorrhages became absorbed, but the patient soon after died of cerebral apoplexy. His eleventh reported case occurred in a perfectly healthy man, forty-two years of age, who complained of periodically recurring and transient redness of the conjunctiva and dimness of vision of one eye. There was œdema of the retina and papilla of this eye and some delicate hemorrhages. The patient complained of severe headache, particularly after any bodily exertion. About three months later he died suddenly from cerebral apoplexy. All these symptoms pointed to an abnormal state of the cerebral circulation.

The following four cases were under the writer's own observation for a time, and as the various symptoms point to an intimate connection between lesions of the retina and lesions of the brain, the histories will be given somewhat in detail:—

CASE I.—A. P., aged sixty-three, English, married, a book-keeper, applied to me in 1871 for an affection of the right eye, of some fourteen months' standing. He complained of a suddenly occurring dimness of vision, coming on at irregular periods, lasting a varying length of time, though never more than a few hours, and always being more intense when it first appeared, and gradually growing better. He said he had always led an exceptionally temperate life, and was apparently in excellent health. On examining the eye there was nothing abnormal externally, but with the ophthalmoscope there were seen a number of small, punctate hemorrhages

all over the retina, and some two or three upon the optic disk itself. There was no cedema of the retina, and no large extravasation anywhere. The retinal veins were perhaps a trifle engorged. The other eye was perfectly normal. His heart was examined and found healthy, as were also the liver and kidneys, the urine having been repeatedly examined and nothing abnormal found. A closer investigation showed disease of the radial and temporal arteries. The patient said that he frequently felt a fulness in the head after a meal or after stooping, but that the feeling soon passed off. Being sure of the connection between the repeated retinal lesions and the cerebral circulation, I cautioned the patient to lead a very quiet life, avoid all undue muscular and mental exertion, and report himself from time to time. He was seen three or four times and then disappeared, and on going to inquire about him, I was informed that he had died from cerebral apoplexy, following a recurrence of the dimness of vision. The death took place about eighteen months after the first appearance of the retinal lesion.

CASE II.—R. H., aged fifty-four, Irish, married, a gardener, applied to me for a sudden loss of sight in the left eye, which had come on two days before, while working at his business. The patient was short and stout, of full habit, and had in former years been a hard drinker. He had suffered from vague rheumatic pains for years, but had never had any distinct attack of rheumatism. He said he had always considered himself a healthy man until this failure of his sight. On testing his vision, I found he could count fingers at about ten feet, and could just make out Snellen CC at three feet; the vision in the other eye was normal. With the ophthalmoscope there were seen three large hemorrhages in the retina, two in the course of the ascending vein, and one along the main branch of the descending vein. There was no cedema and no pulsation, and the other eye was normal. His heart was examined and found healthy, though it was beating much more rapidly than was normal, but this, he said, had been the case for years. The urine was repeatedly examined, but nothing could be found that pointed to renal disease. His arteries were slightly atheromatous, but not markedly so. The patient was seen from time to time, and occasionally some small fresh hemorrhages made their appearance in the retina. He died suddenly one night after running rapidly some distance, with all the signs of cerebral hemorrhage.

CASE III.—W. H. B., American, aged fifty-two, single, a lumberman, complained of a sudden attack of blindness in both eyes, which had come on about a month before. Since then the vision had improved somewhat, though it was still very dim. The patient had been a man of violent passions, a hard drinker, and, while in the army, had contracted a severe type of malarial fever in some of the swamps of the Southwest, from which he had never entirely recovered. The liver was considerably enlarged, occasionally painful, and he suffered habitually from dyspeptic symptoms. There was a loud, blowing murmur over the base of the heart, synchronous with the first sound. I could detect no disease of the kidneys, though there was occasionally some pain in the lumbar region. On examining his

eyes the vision was found reduced to $\frac{20}{C}$, and the ophthalmoscope showed numerous hemorrhages in the retina of variable size and shape, most of them undergoing retrogressive metamorphosis. The extravasations were so numerous as to give a general brownish colour to the whole fundus. The patient was told plainly the condition of affairs and the danger in which

he stood, and was advised to return to his home in Wisconsin and lead a quiet life. This he promised to do, but I afterwards heard that he had become paralyzed, and died unconscious, probably from cerebral hemorrhage.

CASE IV.—Mrs. T. C. S., aged sixty-four, applied to me in February of this year for a failure of vision which had come on suddenly in both eyes, and which had gradually grown worse. On examination, vision with the right eye was $\frac{10}{CC}$, and with the left $\frac{20}{C}$. With the ophthalmoscope there were seen numerous large hemorrhages in the right retina, and incipient cataract. The extravasations were all in the course of the large retinal veins. In the left eye there were not nearly so many clots, and they were smaller than in the right eye. There was also an incipient cataract in this eye. The patient is of very full habit, short and stout, with chronic valvular disease of the heart, and a marked arcus senilis. She also suffers from chronic cystic catarrh and a femoral hernia of the right side. The urine has been examined carefully, and neither albumen nor casts have been found. The patient is still under observation, but I expect to hear of her death by cerebral hemorrhage, which may occur at any time.

It is a well-known fact that hemorrhage into the retina is a common accident in the advanced stages of chronic Bright's disease. Dr. George Johnson, of King's College Hospital, London, has advanced some interesting points explanatory of their causation, in the *Medical Times and Gazette* for July 2, 1870. In this disease of the kidneys, he says, the muscular walls of the minute arteries in most of the tissues, are much hypertrophied, owing to long-continued overaction. Excessive contraction of the minute systemic arteries impedes the onward movement of the blood, and calls for increased efforts on the part of the heart to carry on the circulation. Hence hypertrophy of the left ventricle. An obvious result of the struggle between the increased action of the heart and the increased arterial resistance is an increased strain and pressure on the arterial walls, and a consequent increased risk of hemorrhage from rupture of one or more minute arteries, such as we frequently meet with in a punctate cerebral hemorrhage. Dr. Johnson has observed in cases of Bright's disease with hypertrophy of the left ventricle, that, while as a rule the minute arteries in all the tissues have their muscular walls hypertrophied, the hypertrophy of the arteries of different tissues in the same subject is sometimes unequal. May not the hemorrhages into the retina and brain, that we meet with in these cases, be due to the fact that the increased propelling force of the hypertrophied left ventricle was not counterbalanced by an equivalent hypertrophy, and consequent resisting power in the minute cerebral and retinal vessels? Of course we must depend upon the microscope for solving the question whether the retinal vessels are hypertrophied or not, in cases of chronic Bright's disease, and, unfortunately, we are not very often able to get possession of the eyes of patients who have died from chronic renal disease. I was fortunate

enough, during the past summer, to follow up a case of retinitis albuminurica with hemorrhages, which I had seen in consultation. I was present at the autopsy, and got possession of one kidney, the heart, and one eye. A careful microscopic examination showed a very marked hypertrophy of the renal capillaries and small vessels of the heart, but the retinal and choroidal vessels were not much hypertrophied, though their walls were somewhat thicker than normal. This one case seems to go to support Dr. Johnson's views, but we need more cases. The situation of the hemorrhages in the retina which accompany retinitis albuminurica is somewhat different from the situation of retinal clots occurring in other forms of retinitis, though not always so; at least this is the conclusion I have drawn from my observations. We must recollect that in the class of cases now under consideration there is a pathological process going on in the eye, which if not always a strictly inflammatory one, yet always induces permanent destructive changes in the retina. We may say that there is always an inflammation of the retina present, the morbid process at first going on in the inner layers of the retina, anterior to and also involving the retinal vessels. There is always a degeneration of these vessels, and very soon the engorged and tortuous vessels rupture and extravasations of blood occur, partly in the form of fine, radiating streaks between the bundles of nerve fibres, partly in the form of larger oval or circular spots rendering it very difficult to recognize the smaller vessels. I have observed almost invariably that these hemorrhages occur around the posterior pole of the eye, or rather round the entrance of the optic nerve, and between the disk and the macula. They seem, as a rule, to have the form of the spokes of a wheel, radiating from the optic papilla as a centre. They occur most frequently in the advanced stages of the morbid process of the retina, after the outline of the papilla has become obscured, and the disk has become surrounded by a wall of brawny infiltration. On this wall small hemorrhages occur very frequently. There does not appear to be any particular period in the course of the renal disease at which these hemorrhages occur, though we are far more likely to meet with them at the period when the excretion of urine is more and more interfered with, consequent upon the atrophy of the renal tissue. Here the general circulation becomes more and more impeded, and the tension of the vascular system, augmented by the increased action of the hypertrophied ventricle, finally reaches a point where rupture ensues and extravasations occur. The blood does not always come from the larger vessels, though it sometimes does. *Hulke* says that he does not recollect an instance among the cases which he submitted to microscopic examination, in which the hemorrhage came from the larger vessels; it was always from the capillaries. The hemorrhages are usually in the inner layers of the retina, next the vitreous humor, though sometimes they infiltrate the whole thickness of the retina, and are even met with between the choroid and retina. In the case mentioned

above, in which I was fortunate enough to obtain the eye for examination, the extravasations in the retina were all in the nerve fibre and internal granule layers, but there were two or three clots in the swollen tissue of the optic disk, and quite a large one in the tissue of the nerve itself, just in the region of the lamina cribrosa. In this case the extravasations came from both large vessels and capillaries. Another point which I have observed in cases of retinitis albuminurica, is that retinal hemorrhages scarcely ever occur unless there is at the same time organic disease of the heart. They do occur sometimes where there is no cardiac complication, but this is not often the case. During the past three years I have had the opportunity of observing eighteen cases of retinitis associated with renal disease, and from these cases I have drawn the above conclusion.

The first case was a man, 30 years of age, who had all the symptoms of chronic Bright's disease, with affected vision in both eyes. The ophthalmoscope showed infiltration of the retina at the macula lutea, round the optic nerve, and between the nerve and the macula, and at the periphery near the ora serrata, there were patches of choroidal atrophy. Between the nerve and the macula in each eye were a number of longitudinal hemorrhages, always more superficial to the peculiar yellowish-white, glistening exudations. This man had hypertrophy of the left ventricle of the heart, with chronic valvular disease. He had moderate œdema of the face and extremities, frequent attacks of uræmic amblyopia, and marked dyspnœa. The urine contained albumen and fatty casts.

Case second was a man, 32 years of age, who had, when first seen, the peculiar stellate exudation round the macula and a brawny infiltration of the optic papilla, with a few small thread-like hemorrhages round the nerve entrance and upon the disk. Three weeks later he complained of being entirely blind in the left eye, and on examining him with the ophthalmoscope, the whole vitreous humor was found opaque, probably from a large hemorrhage, which completely concealed the fundus. This man had a tremendous rough, blowing sound at the apex of the heart, synchronous with the first sound, with marked hypertrophy. His urine contained albumen and granular casts.

Case third was a woman, 60 years of age, with œdema of the legs and feet, marked ascites, pale waxy complexion, and some dyspnœa. There was a mitral regurgitant murmur, hypertrophy of the heart, and constant palpitation. The retinae of both eyes were strewn with hemorrhages, but there was very little exudation into the tissue of the retina. The urine contained albumen, but no casts.

Case fourth was a man, 23 years of age, and was an exceptional one, in that, though the retinal hemorrhages were very abundant, and the renal symptoms most marked, he had no cardiac lesion.

Case fifth was a man, 55 years of age, in whom the hemorrhages were confined to the right eye, though both retinae were involved in the fatty degeneration. He had both valvular disease and hypertrophy of the heart. The urine contained albumen and casts.

Case sixth was a man, 43 years of age, with hemorrhage in both eyes, fatty degeneration of the retinae, and hypertrophy of the heart, but no valvular lesion. He had uræmic convulsions, and his urine was loaded with albumen and casts.

Case seventh was a boy, aged 15 years, with fatty infiltration of the retina in each eye, but no hemorrhages. He had no heart disease, and no very pronounced signs of chronic renal disorder except frequent micturition, though there was a history of convulsions and his urine contained albumen.

Case eighth was a woman, 18 years of age, with very marked retinitis albuminurica in both eyes, but no hemorrhages. She had no cardiac disease, but a great deal of general anasarca. Urine albuminous.

Case ninth was also a woman, 19 years of age, with retinitis albuminurica in both eyes, though most developed in the right eye, but there were a large number of hemorrhages on and around the optic papilla. She had had acute articular rheumatism three years before, and had both valvular disease and hypertrophy of the heart. The urine contained neither albumen nor casts.

Case tenth was a man, 23 years of age, with retinitis albuminurica but no hemorrhages. There was no cardiac disease, but the liver was very much enlarged, and there was considerable abdominal dropsy. The urine contained albumen, but no casts.

Case eleventh was a woman, 35 years of age, with retinitis nephritica, and enormous hemorrhages in both retinae. There was chronic valvular disease of the heart and some hypertrophy. The urine was albuminous, but contained no casts.

Case twelfth was also a woman, 47 years of age, with hemorrhages in each eye, punctate in character, and a general oedematous appearance of the retinae. She had both hypertrophy and valvular disease of the heart. The urine contained albumen and casts.

Case thirteenth was a woman, 25 years of age, with typical retinitis albuminurica, but no hemorrhages, and this patient had no cardiac complication.

Case fourteenth was a woman, 50 years of age, with incipient cataract and posterior staphyloma in the left eye, and retinitis nephritica with many hemorrhages in the right eye. She had chronic valvular disease and hypertrophy of the heart.

Case fifteenth was a woman, 43 years of age, with both eyes affected by the peculiar exudation accompanying chronic Bright's disease, and numerous small hemorrhages in both eyes. Chronic valvular disease and very marked hypertrophy of the heart. Urine loaded with albumen and casts.

Case sixteenth was a woman, 20 years of age, who had for several months suffered from general anasarca and occasional convulsions, epileptiform in character. There was no history of rheumatism, and on examining her chest no cardiac disease was detected. Her urine was nearly half solid with albumen, and contained casts of all kinds. With the ophthalmoscope the retina of each eye was seen to be the seat of the peculiar changes accompanying Bright's disease, but there were no hemorrhages. This case I had an opportunity of observing from time to time for more than a year, and at no time was there any extravasation of blood seen.

Case seventeenth was a woman, 25 years of age, in whom the renal trouble was consequent upon a gravid uterus. It was her first pregnancy, and during the sixth month she had some swelling of the feet and ankles, and shortly afterwards a series of convulsions, which lasted till evening, when she aborted. Immediately after this her eyesight began to fail, and she complained of dyspnoea and palpitation. On examining her eyes, I saw a neuro-retinitis in both, with enormous exudation into the disk and

retina and upon the disk two considerable hemorrhages in the left eye, and a number of smaller ones in the right eye. An examination of the chest revealed hypertrophy and valvular disease of the heart. A few days later, an examination showed several fresh hemorrhages from the horizontal vessels in both eyes. This patient afterwards died from what was probably cerebral hemorrhage, as she was paralyzed on the left side and died comatose.

Case eighteenth was one of monocular retinitis albuminurica in a woman, 39 years of age. In the right eye there was a general haziness of the fundus, and the veins were engorged and tortuous. In the left eye, below and between the nerve and the macula, was a yellowish mass of exudation in the deeper layers of the retina, from which radiated streaks or lines of the same colour. Just above the main mass of exudation were several hemorrhagic spots of varying size, and one or two small, punctate extravasations upon the optic disk. This woman had both hypertrophy and valvular disease of the heart, and her urine contained both albumen and casts.

In going over these eighteen cases hastily, we see that in eleven cases of retinal hemorrhage there was valvular disease and hypertrophy of the heart. In one case of hemorrhage, there was hypertrophy of the heart, but no valvular disease. In five cases there were no hemorrhages in the retina, and no cardiac disease of any kind. And finally in only one case was there retinal hemorrhage without at the same time cardiac lesion. These results, though taken from a small number of cases, seem to bear out the opinion already expressed, that retinal hemorrhages rarely accompany retinitis albuminurica, unless the renal disease is complicated by disease of the heart.

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